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STUDY PLAN -

N ↑ *Hennigan Orchard Study, 1994 - Evaluation of Bacillus thuringiensis to Control Peach Twig Borer*

Treatment Plot

Sample Trees



1



2



3



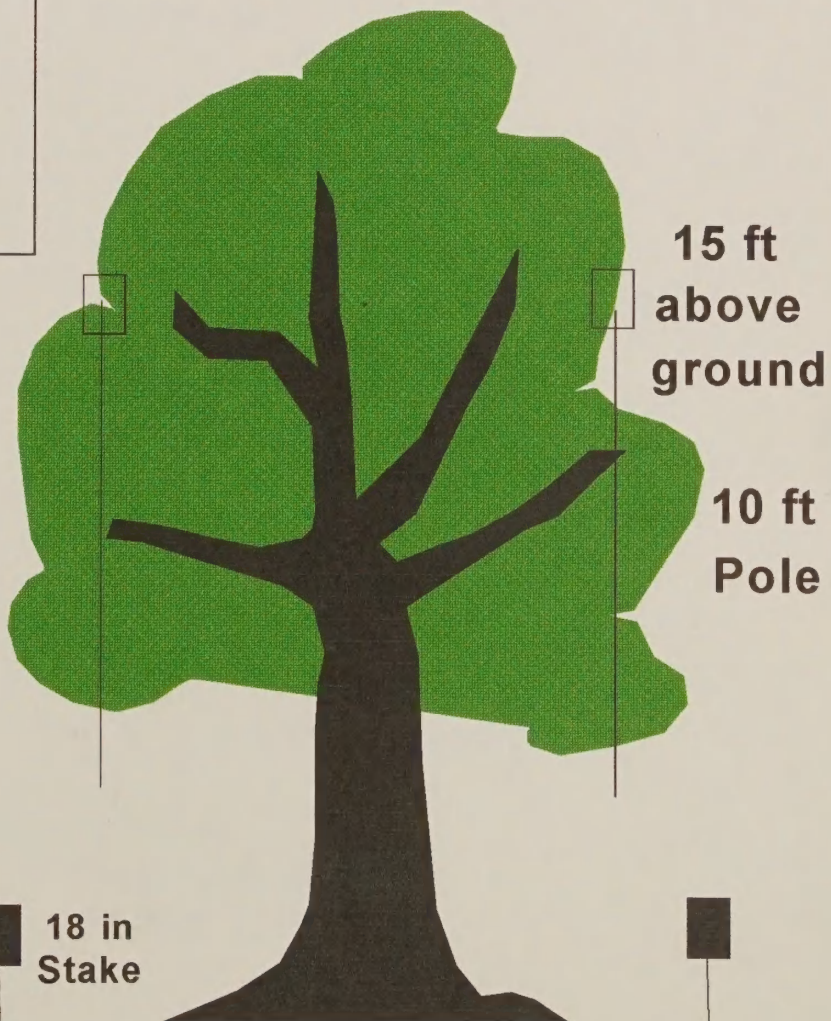
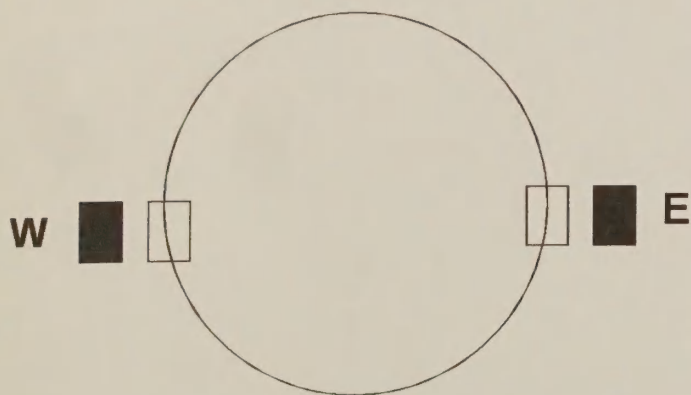
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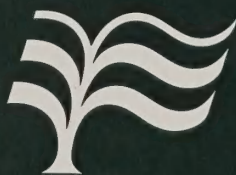
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Mean canopy 25 ft

Top View



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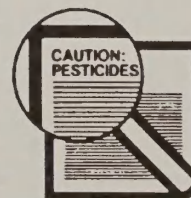
Pesticides used improperly can be injurious to human beings, animals, and plants. Follow the directions and heed all precautions on labels. Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides where there is danger of drift when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment, if specified on the label.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Environmental Protection Agency, consult your local forest pathologist, county agriculture agent, or State extension specialist to be sure the intended use is still registered.



FPM 94-4
February 1994

Study Plan

Hennigan Orchard Study
1994 - Evaluation of
Bacillus thuringiensis
to Control Peach Twig
Borer

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Table of Contents

	Page
INTRODUCTION	
Background	3
Scope	4
Objectives and tasks	4
METHODS	
Study design	5
Biological sampling and assessment	6
Spray deposit sampling and assessment	7
Aerial application	7
Meteorology	8
ANALYSES	
Task 1 - Efficacy	9
Task 2 - Spray deposition	9
Task 3 - Operational prescription	9
Task 4 - FSCBG models predictions to observed deposition	9
RESPONSIBILITIES	10
TECHNOLOGY TRANSFER	11

FIGURES AND TABLES

Figure 1 - Plot diagram (map)	12
Figure 2 - Arrangement of sample trees	14
Figure 2a- Spray deposit sampling equipment	17a
Table 1 - Study matrix	15
Table 2 - Card/can marking method	17
Table 3 - Application parameters Phase A	18
Table 4 - Application parameters Phase B	19
Table 5 - Application parameters Phase C	20
Table 6 - Application parameters Phase D	21
Table 7 - Tank mix and Bt requirements	22

APPENDICES

A. BT LABELS
B. FRANK ZALOM MEMORANDUM
C. CP NOZZLE FLOWRATE TABLE
D. DYES - SPECIFICATIONS AND MSDS
E. METHODS FOR ASSESSING DROP STAINS
F. GENERAL SITE MAP

INTRODUCTION

Background

California produces virtually all of the almonds in the United States and over half of all the almonds in the world. Over half of the production is for export to other countries. Several insect pests injure almond trees or nuts, but the most important for most growers are navel orangeworm, peach twig borer and San Jose scale. Navel orangeworm is typically controlled by cultural methods and, when needed, a hull split spray of an organophosphate insecticide. Peach twig borer and San Jose scale are typically managed with a dormant season application of an oil and an organophosphate insecticide (usually diazinon, chlorpyrifos or methidathion). Most applications are made by ground with an orchard sprayer, but some are made by air. The dormant spray has been the recommended control for peach twig borer in almonds, peaches, nectarines, apricots, plums and prunes during the past 19 years. It was thought to be non-disruptive because it is applied at the time of the year when the natural enemies of other insects and mites are not present in the orchards, and it has therefore been considered an important integrated pest management tactic.

Recently, the use of organophosphate insecticides in dormant sprays has come to be questioned because they have been implicated in poisonings of the red tailed hawk, and important raptor in the central valley, and in runoff into waterways. As a result, regulatory agencies have been examining the registration of organophosphate insecticides for use in the dormant season, and their use may be eliminated or severely limited.

Our work targets the peach twig borer because its feeding results in direct damage to the nuts. If left untreated, damage to almonds can exceed 30 %. Before synthetic organic pesticides were available, the peach twig borer was considered to be the most important insect pest of almonds. It is believed that if conventional pesticides could be eliminated from the almond production system, the San Jose scale might be brought under satisfactory natural biological control in most instances.

Bloomtime applications of Bacillus thuringiensis (Bt) have been shown to be effective in controlling peach twig borer in recent studies conducted by the University of California. Recommended control using Bt requires two treatments, one at the "popcorn" stage and one at petalfall. This timing is very critical to success. Most of the research to date has been with ground applications and aerial applications. Using conventional application techniques are not believed to be effective. Although a significant amount of almond acreage could use ground applications, some growers must apply the treatments by air if either the ground is too wet for spray equipment to enter the orchards or if their orchards are too large to permit ground application during the critical timing window.

Scope

This study will consist of four aerial treatments designated by Phase A, Phase B, Phase C, and Phase D (Table 1). The study will be conducted during January - March 1994 at the Hennigan almond orchards, Chico, CA. (See Appendix F for location of orchards). Phase A will be conducted on a single day in January and the other phases on single days but repeated twice. The study is a cooperative effort of the grower Bob Hennigan, the University of California Extension, Entotech, Inc., and the USDA Forest Service. The first treatment (Phase A) will involve a one-time conventional operational treatment with subsequent treatments being three different tank mixes of Bacillus thuringiensis (Bt). The Bt will be commercial formulations of Entotech products applied at pre-bloom popcorn stage and again at post-bloom petal fall stage. Each treatment will be replicated four times and plots randomly selected for treatment.

Objective

To evaluate the feasibility of using Bacillus thuringiensis as a control agent for peach twig borer the following tasks will be pursued:

1. Determine the efficacy of each treatment and compare efficacy from treatment to treatment and to untreated control plots;
2. Determine spray deposition volume, drop size, and number of drop stains recovered at sample tree drip line and in the canopy;
3. Develop operational guidelines for treating peach twig borer in stone fruit crop trees with Bacillus thuringiensis; and
4. Exercise the canopy penetration code of the FSCBG aerial spray model using meteorological data collected during the treatments and compare predictions with spray deposition recoveries at the drip line and in the canopy.

METHODS

Study Design

The study design is based upon four replications for each treatment and four untreated control plots for a total of 20 plots (Figure 1). As a baseline to compare efficacy of Bt treatments to a standard treatment method, the design includes a conventional chemical treatment. The conventional treatment will be applied in January during dormancy. The other three treatments, conducted the end of February and early March, will be involve different tank mixes of Bt (Table 1), each containing a different dye to determine whether spray drifted into adjacent plots. Plots will be treated at both popcorn and petal fall stages (a period of about 10 days apart) as determined by the grower or farm advisor. Note that the pollinator trees bloom before start of the popcorn stage of the main portion of the orchard. Pollinator blooming will signal an alert that treatment of the popcorn stage should begin in a few days.

There is no current method of determining pre-spray populations of the peach twig borer; therefore the biological assessment will be conducted after the petal fall treatment by counting the number of surviving larvae on tree trunks. Counts will be done on the trees designated for the spray deposit sampling. Five trees will be identified in the center and on a north/south line of each plot.

Trees at the Hennigan orchard are on 26.5 foot centers forming a mean orchard canopy height of 25 feet.

Information on the insecticide labels and dyes are in Appendix A and D respectively.

Biological Sampling and Assessment

The effect of treatments on peach twig borer will be assessed in two ways. First, all scaffolds from at least five trees in the center rows of each treatment will be encircled with cardboard bands stapled to the bark in early March. During March, larvae on the trees will crawl down the scaffold to find secluded places for pupation. It is believed that the larvae will pupate in the cardboard bands. The bands will be removed from the trees in early April before the adults emerge. Adult emergence will be determined using pheromone traps placed in the orchard. The bands will be returned to the laboratory at UC Davis and will be dissected to remove and count the relative number of pupae remaining in the treated and untreated plots. A second method of assessing peach twig borer populations will be by counting the number of shoot strikes in early April that resulted from feeding of overwintering larvae emerging from their hibernacula. Shoot strikes per tree will be assessed on replanted trees from the center of each of the plots. Replant trees will be used for this assay because their shoot growth is more vigorous than on the older trees in the orchard making it easier and more accurate to determine the number of shoot strikes.

Spray Deposit Sampling

The spray will be monitored with Kromekote cards placed in the tree canopy and near the ground beneath the tree dripline of each of the five designated sampling trees (Figure 2), in all 20 plots. Purpose of this sampling is to determine the quality of application and spray deposition coverage, and to determine where the spray deposited relative to other treatments and plots. The aim is to place as much spray and as evenly as possible into the canopy and not on the orchard floor. The 1992 study demonstrated excellent crown coverage when undiluted Bt was applied by Ag Cat and Micronairs. Spray coverage, however, was better at petal fall when there was more foliage thus more canopy turbulence. We expect to observe a similar phenomena on this study.

Kromekote cards measuring 8 x 11 cm will be wrapped on sides of aluminum soft drink cans. Also a Kromekote cut square measuring 6.3 x 6.3 cm will be attached to the top of each can. The cans will be extended (Figure 2) by 1/2" thick-walled PVC pipe. There will be one on the east and another on the west side of the crown (Figure 2) extending up from the ground 15 feet. Additionally there will be a can extended on PVC 18" above the ground at the drip line on the east and west sides of each sample tree. Cards will be positioned the morning of the scheduled spray day and retrieved the same day of treatment after spraying. Card will be marked as shown in Table 2.

Each tank mix will contain a different colored dye (Table 7) to aid in assessment of spray deposition for the purpose of monitoring drift from one plot to another. The cards will be assessed for number number and size of drop stains and spray volume using an image analyzer and a software program developed for this assessment. Cards with more than one color of drop stains will be assessed visually. Information on assessing the cards is in Appendix E.

Spray drift sampling may be conducted with cards placed directly on the ground downwind of the treatment plots subjects to resources and time availability.

Aerial Application

The plots will be treated by aircraft applying spray on a north-south, south-to north swathing pattern. Application parameters for each Phase (A,B,C, and D) are presented in Tables 2,3,4, and 5. A Bell Jet Ranger 206 helicopter will be used in Phases A-C and an Ag Cat will be used in Phase D. The aircraft will be calibrated to apply the spray along a swath width of 41 feet at 5 feet above canopy. The CP nozzle will be used on Phases A-C and the Micronair on Phase D. The Micronair will be placed along the microfoil boom of the Ag Cat. Nozzles and atomizers should be positioned to the extent possible evenly along the boom and not to exceed 75% the length of the wing or rotor.

Tank mixes with quantities of Bt and dye are detailed in Table 7.

Meteorology

Meteorology will be monitored at each of the sub-orchards during treatment. The purpose is to provide operational information for placement of the spray drift detection cards, to record precipitation, and to record data for input to the FSCBG model for post-treatment comparison to FSCBG canopy penetration and drift predictions.

The monitoring support which MTDC will provide to this study will consist of two fully instrumented EMCOT stations with instruments located at the 2-m and 7-m levels. Each station will consist of two levels of wind speed and direction, two levels of temperature and two levels of humidity. Net radiation and the vertical wind component (w) will be measured. A raingauge will also be deployed.

The anemometers will be either 8-slot photochoppers or rotating magnet cup anemometers (Met One, Inc.). Wind direction will be measured using vane potentiometers (Met One, Inc.). Humidity will be measured using a capacitance element (R.M. Young, Inc.). Temperature measurements are accomplished using a thermistor and net radiation is measured with a thermopile between upward and downward facing black plates (REBS, Inc.). The vertical wind component will be measured with a Gill propeller anemometer. The raingauge will be a tipping bucket type and will be purchased for this study.

Data logging will be accomplished using a CR-10 (Campbell Scientific, Inc.) data logger. The system is run by a rechargeable battery which is in line with a solar cell. The mounting tower itself will extend to 7m height. In this study it is anticipated that instruments will be mounted at approximately 2m and 7m on the tower. Exact siting of the equipment will be determined on site after a walkover. Two systems will be deployed and a third will be held in reserve as backup.

Data will be collected at 1Hz and reduced to 10-minute averages for model validation purposes. The high frequency data will be collected so that variance can be accurately determined for all the variables.

ANALYSES

Task 1

The number of peach twig borer pupae from all scaffold bands on a single tree will be pooled to determine total pupae in each tree. The average numbers of pupae per tree in each treatment replicate will be determined (minimums of five trees per treatment replicate). The biological data from each treatment (replicated four times) will be subjected to analysis of variance, and means of each treatment will be compared to the untreated control treatment using LSD at the 5% level. The number of shoot strikes on each replant tree will be averaged for each treatment replicate. The average shoot strikes per tree from each treatment (replicated four times) will be subjected to analysis of variance, and means of each treatment will be compared to the untreated control treatment using LSD at the 5% level as was done for pupae in the tree bands.

Task 2

Spray deposit data will be analyzed statistically for difference among sample trees, plots and treatment. Both ground and canopy data consisting of drop number, drop size, and spray volume will be used as data units. Questions to be answered are variation in deposition from sample tree to sample tree in each plot, each treatment, and treatment to treatment. (See Appendix E).

Task 3

Successful Bt efficacy results will be developed into an operational prescription both for the high volume and ULV application. This will include recommendations on how to apply spray, type nozzles, release height, etc.

Task 4

Spray deposit recoveries will be compared to FSCBG post spray model predictions and statistically analyzed. The purpose is to continue the evaluation of FSCBG's ability to predict canopy deposition in deciduous canopies.

RESPONSIBILITIES

1. Frank Zalom, University of California, (916) 752-6004. Study coordination, select, and mark sample trees, statistical analyses of the data, biological assessment, provide and coordinate field sampling crew, reporting, and special use permits.
2. Gary Kirfman, Entotech, Inc. (916) 757-4750. Provide sampling poles, Bt formulations, field assistance, pay cost of Russ Stocker consultation and spray applications, and deliver the Bt to Chuck Jones Flying Service at Biggs, CA.
3. Bob Hennigan, Hennigan Orchards, Inc. (916) 891-1862. Provide orchard for study and coordinate application with Chuck Jones Flying Service.
4. Jack Barry, USDA Forest Service, (916) 758-4600. Prepare and coordinate study plan, provide Kromekote card/can samplers, provide for assay of cards, prepare report on assay, coordinate spray aircraft parameters with applicator, provide supplemental meteorological station, and provide 6 each Micronair AU 5000 rotary atomizers, and coordinate Russ Stocker's consultations. Jack will also deliver the dye to Chuck Jones Flying Service.
5. Russ Stocker, Arena Pesticide Management, Inc., (916) 757-1550. Assist Dale and Tiger Jones in installing Micronairs on Ag-Cat.
6. Tiger and Dale Jones, Chuck Jones Flying Service, (916) 868-5798. Apply the Bt tank mixes on the Hennigan Orchard with Bell 206 Jet Ranger and Ag-Cat. Entotech, Inc. has agreed to pay for costs.
7. Joe Connell, Farm Advisor, (916) 538-7201. Monitor Hennigan orchard and provide 3 day alert prior to treatments.
8. Pat Skyler, USDA Forest Service, (916) 758-4600. Field data recording including spray start and spray stop times, and assisting in positioning samplers.
9. Wayne Johnson, University of California, (916) 752-4648. Assist in positioning and transport of samplers and assist in biological assessment.
10. Harold Thistle, USDA Forest Service, Missoula Technology Development Center, (406) 329-3981. Provide EMCOT meteorological instrumentation, installation, calibration, and data reduction.

TECHNOLOGY TRANSFER

The USDA Forest Service (FS) has developed technology to support aerial application to trees and forests. The FS maintains both coniferous and deciduous forest for seed production that require pesticide applications to control a variety of pests. In addition the FS applies biorational pesticides to control insects such as the gypsy moth and other defoliators that threaten balanced ecosystems. The FS aerial technologies include a spray deposition and drift model, Bt ultra low volume application methods, and methods of sampling spray depositions and air concentrations. Therefore the FS has technology and it is pleased for the opportunity to transfer to the agricultural community.

This project involves several public agencies and the private sector including the US Forest Service, the University of California's Statewide Integrated Pest Management Project, Butte County Cooperative Extension Service, Entotech (a producer of Bt), Scientific Methods Inc. (A private crop consulting service) and a private almond grower. The Statewide IPM Project produces the US Pest Management Guidelines that provides information to growers on best practices. Application methodology developed from this research can be directly incorporated into the University's guidelines. The Cooperative Extension Service in Butte County, California is cooperating in this study and the responsible advisor can pass along information to other growers in the county and region. Similarly, Scientific Methods Inc., which provides services on pest management practices for almost 12,000 acres of orchards in the region will be part of the project and can quickly adapt the results for use by other growers.

Results meeting study objectives and tasks will be published in agricultural publications, USDA extension bulletins, and scientific journals as appropriate.

Hennigan Orchard

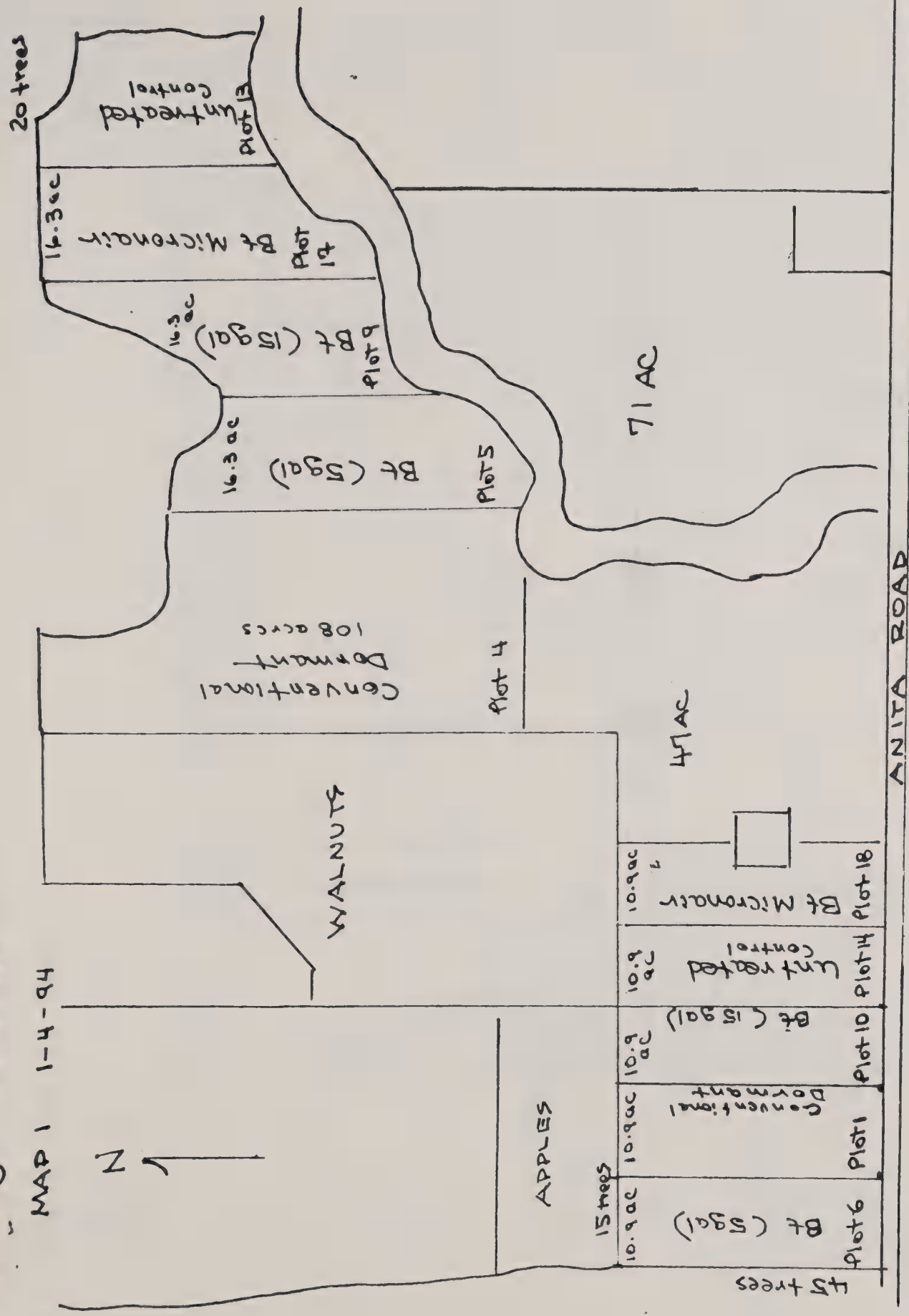


Figure 1 - Plot diagram, Hennigan orchard study, 1994.

CROWDER
(MAP 2)

CROWDER BLOCK

MAP 2 1-4-94

↖

WILSON LANDING ROAD

Plot 15	Untreated Control	8.1 ac
Plot 3	Conventional Dormant	8.1 ac
Plot 19	Bt Micronair	8.1 ac
Plot 11	Bt (15 gal)	8.1 ac
Plot 7	Bt (5 gal)	8.1 ac

25 tree rows

POWER LINE

Plot 12	Bt (15 gal)	8.1 ac
Plot 8	Bt (5 gal)	8.1 ac
Plot 20	Bt Micronair	8.1 ac
Plot 2	Conventional Dormant	8.1 ac
Plot 16	Untreated Control	8.1 ac

25 tree rows

Figure 2 - Arrangement of sample trees and placement of Kromekote can samplers, Hennigan orchard study, 1994.

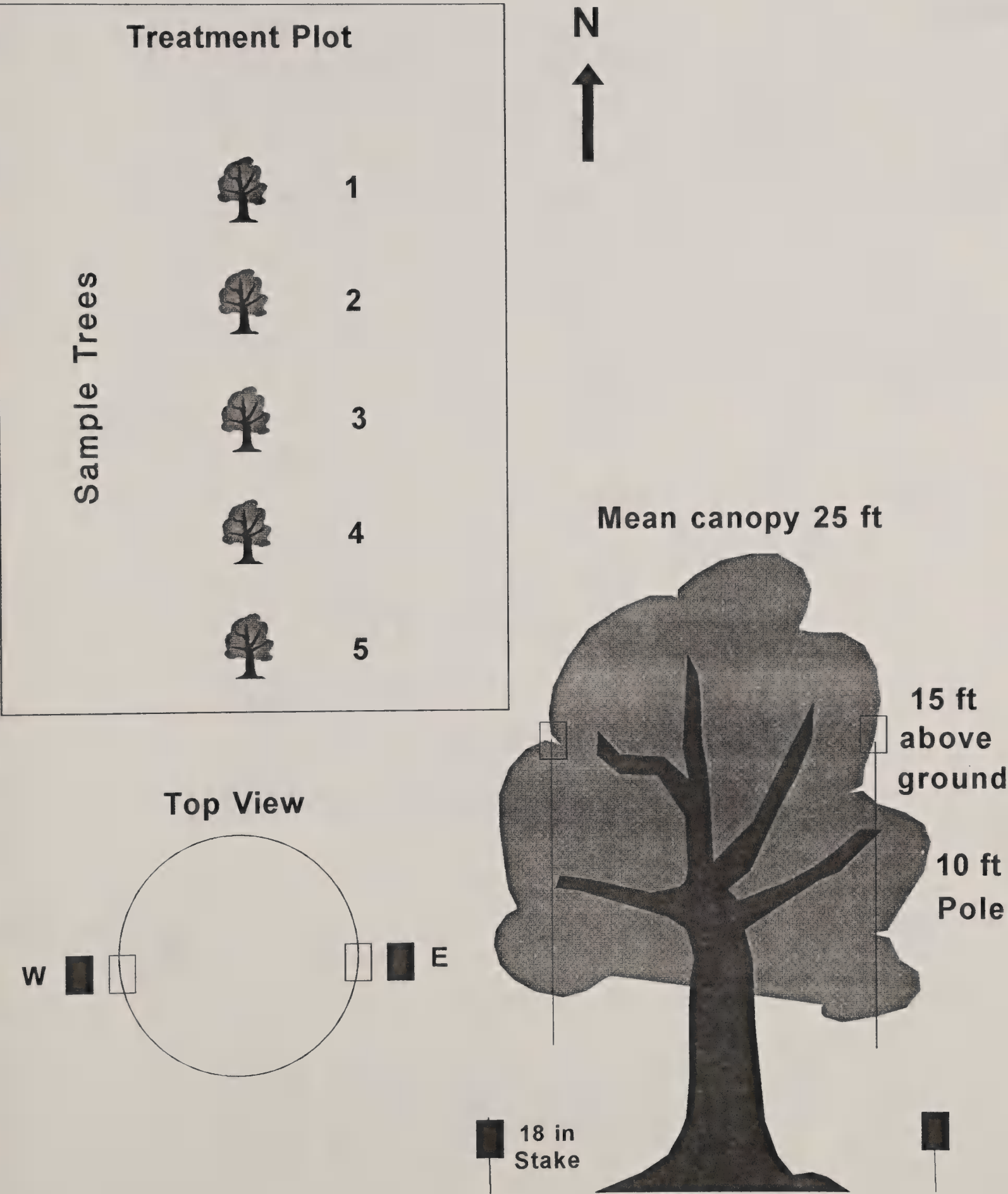


Table 1 - Study matrix, Hennigan Orchard Study, 1994.

Treatment	Treatment Phase	Tank Mix ¹	Application Rate (gpa)	Release ² Height (ft)	Plot No.	Acres	Notes
Dormant	A	Operational	20	5	10	10.9	3
Dormant	A	Operational	20	5	2	8.1	
Dormant	A	Operational	20	5	3	8.1	
Dormant	A	Operational	20	5	4	108.0	
Popcorn	B	Bt 1 lb (14.6 BIU)	5	5	5	16.3	4
Popcorn	B	Bt 1 lb (14.6 BIU)	5	5	6	10.9	
Popcorn	B	Bt 1 lb (14.6 BIU)	5	5	7	8.1	
Popcorn	B	Bt 1 lb (14.6 BIU)	5	5	8	8.1	
Popcorn	C	Bt 1 lb (14.6 BIU)	15	5	9	16.3	
Popcorn	C	Bt 1 lb (14.6 BIU)	15	5	1	10.9	
Popcorn	C	Bt 1 lb (14.6 BIU)	15	5	11	8.1	
Popcorn	C	Bt 1 lb (14.6 BIU)	15	5	12	8.1	
Popcorn	-	Control	-	-	13	8.1	
Popcorn	-	Control	-	-	14	10.9	
Popcorn	-	Control	-	-	15	8.1	
Popcorn	-	Control	-	-	16	8.1	
Popcorn	D	Bt 0.5 gal (24 BIU) ULV	0.5	5	17	16.3	5, 6
Popcorn	D	Bt 0.5 gal (24 BIU) ULV	0.5	5	18	10.9	
Popcorn	D	Bt 0.5 gal (24 BIU) ULV	0.5	5	19	8.1	
Popcorn	D	Bt 0.5 gal (24 BIU) ULV	0.5	5	20	8.1	

Treatment	Treatment Phase	Tank Mix	Application Rate (gpa)	Release Height (ft)	Plot No.	Acres
Petal Fall	B	Bt 1 lb (14.6 BIU)	5	5	5	16.3
Petal Fall	B	Bt 1 lb (14.6 BIU)	5	5	6	10.9
Petal Fall	B	Bt 1 lb (14.6 BIU)	5	5	7	8.1
Petal Fall	B	Bt 1 lb (14.6 BIU)	5	5	8	8.1
Petal Fall	C	Bt 1 lb (14.6 BIU)	15	5	9	16.3
Petal Fall	C	Bt 1 lb (14.6 BIU)	15	5	1	10.9
Petal Fall	C	Bt 1 lb (14.6 BIU)	15	5	11	8.1
Petal Fall	C	Bt 1 lb (14.6 BIU)	15	5	12	8.1
Petal Fall	-	Control	-	-	13	8.1
Petal Fall	-	Control	-	-	14	10.9
Petal Fall	-	Control	-	-	15	8.1
Petal Fall	-	Control	-	-	16	8.1
Petal Fall	D	Bt 0.5 gal (24 BIU) ULV	0.5	5	17	16.3
Petal Fall	D	Bt 0.5 gal (24 BIU) ULV	0.5	5	18	10.9
Petal Fall	D	Bt 0.5 gal (24 BIU) ULV	0.5	5	19	8.1
Petal Fall	D	Bt 0.5 gal (24 BIU) ULV	0.5	5	20	8.1

Footnotes:

1. Tank mix is final mixture. Bt (NOVO Biobit HP) at one (1) pound per acre which is 14.6 BIU's.
2. Release height is feet above top of canopy.
3. Operational is the usual method, nozzles, and pesticide tank mix used by the applicator to treat the Hennigan Orchard. Dormant operational (Phase A) spray was applied to Plots 2-4 and 10 on January 26, 1994.
4. NOVO Biobit HPWP (Phases B, C).
5. ULV Micronair trials (Phase D).
6. NOVO Biobit XL undiluted (Phase D).

Table 2 - Card/Can marking method, Hennigan orchard study, 1994.

Phase (A, B, C, D)

Plot No. (1-20) (Note there are 20 plots 4 of which are untreated controls)

Tree No. (1-5)

Canopy (CW or CE) (Canopy West or Canopy East)

Ground (GW or GE) (Ground West or Ground East)

(EXAMPLE)

A - 1 - 1 - CE

| | | |
| | | |

Phase Plot Tree No. Canopy East

Phase

A	Dormant Conventional	Operational	Supracide, oil, & zinc, 20 gpa
B	Popcorn & Petal Fall	Bt 1 lb, 5 gpa	
C	Popcorn & Petal Fall	Bt 1 lb, 15 gpa	
D	Popcorn & Petal Fall	Bt 0.5 g/a ULV	(Micronair)

Plot No.

1-20 (see map diagram)

Note all plots except 2-4 and 10, which are untreated controls, are treated twice.

Plots

2-4 and 10	Dormant Spray
1, 5-9, 11,12 and 17-20	Popcorn and Petal Fall Spray

Spray Deposit Sample Trees

1-5 in each plot

Table 2a - Spray deposit sampling equipment.

Hennigan Orchard Study, 1994

Cans, Poles, and Stakes Required

1. Plots to be treated and monitored are: 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, and 20 = <u>19 Total</u>	
2. Five sample trees per plot (19 x 5) =	95 Total
3. Each tree has 2 long poles (2 x 95) =	190 Total
4. Each tree has 2 stakes (2 x 95) =	190 Total
5. Cans per day treatment =	380 Total
6. Kromekote cards per day treatment	380 Total
Side can	380 Total
Top can	380 Total

NOTE: Repeat this set-up for the petal fall treatment.

Table 3 - Application parameters, Phase A, Bell Jet Ranger,
Hennigan Orchard Study, 1994.

Parameter	Dormant Treatment
Pilot	Tiger Jones Chuck Jones Flying Service
Aircraft	Bell Jet Ranger 206
Application Ground Speed	30 mph
Release height above canopy	5 feet
Swath width	41 feet
Application rate	20 gpa/50 gpm
Nozzle type	CP plastic
Nozzle orifice size	0.062
Nozzle flowrate @ 65 psi	0.86
Number of nozzles	64
Nozzle orientation	Straight back 85 degree deflector plate
Tank mix	6 lbs Supracide 2 gal oil 7% zinc water
Dye	Rhodamine WT liquid 0.1% (1/4 lb/100 gallons) (8 lbs total)

Table 4 - Application parameters, Phase B, Bell Jet Ranger,
Hennigan Orchard Study, 1994.

Parameter	Treatment #1 (Popcorn)	Treatment #2 (Petal Fall)
Pilot	Tiger Jones Chuck Jones Flying Service	(Same as #1)
Aircraft	Bell Jet Ranger 206	
Application Ground Speed	30 mph	
Release height above canopy	5 feet	
Swath width	41 feet	
Application rate	5 gpa/13 gpm	
Nozzle type	CP plastic	
Nozzle orifice size	0.062	
Nozzle flowrate @ 40 psi	0.682	
Number of nozzles	20	
Nozzle orientation	Straight back 85 degree deflector plate	
Tank mix	Bt 1 lb (14.6 BIU)	
Dye	Blue #5601 (6 lbs total)	

Table 5 - Application parameters, Phase C, Bell Jet Ranger,
Hennigan Orchard Study, 1994.

Parameter	Treatment #1 (Popcorn)	Treatment #2 (Petal Fall)
Pilot	Tiger Jones Chuck Jones Flying Service	(Same as #1)
Aircraft	Bell Jet Ranger 206	
Application Ground Speed	30 mph	
Release height above canopy	5 feet	
Swath width	41 feet	
Application rate	15 gpa/30 gpm	
Nozzle type	CP plastic	
Nozzle orifice size	0.062	
Nozzle flowrate @ 40 psi	0.682 (water)	
Number of nozzles	60	
Nozzle orientation	Straight back 85 degree deflector plate	
Tank mix	Bt 1 lb (14.6 BIU)	
Dye	Grape #5758 (8 lbs total)	

Table 6 - Application parameters, Phase D, Ag Cat aircraft,
Hennigan Orchard Study, 1994.

Parameter	Treatment #1 (Popcorn)	Treatment #2 (Petal Fall)
Pilot	Dale Jones Chuck Jones Flying Service	(Same as #1)
Aircraft	Ag Cat	
Application Ground Speed	110 mph	
Release height above canopy	5 feet	
Swath width	41 feet	
Spray system	6 Micronair AU5000	
Micronair blade angle	50°	
Total application rate	0.5 gal/acre (4.68 liters/hectare)	
Boom pressure	40 psi	
Tank mix	Biobit XL (NOVO product) with 0.1% Rhodamine WT WT liquid dye	
Flowrate, total	4.6 gallons/minute	
Flowrate, per Micronair	0.77 gallons/minute	
Micronair, VRU setting	5	
Dye	Black Shade R (1 lb total)	

Table 7 - Tank mix dye and Bt requirements, Hennigan orchard study, 1994.

- Phase A - **Dormant conventional (chemical) operational**
January 26 treatment was applied to 135.1 acres at 20 gallons per acre. This required 2702 gallons plus another estimated 60 gallons for a total of 2762 gallons. Rhodamine WT liquid was recommended at 1/4 pound per 100 gallons (0.05%) of tank mix. the applicator used 25% less and it provided acceptable color contrast on white Kromekote cards.
- Phase B - **Bt (NOVO Biobit HPWP) 1 lb (14.6 BIU) applied at 5 gallons per acre.**
Total acres = 43.4 acres.
Total Bt = 53 lbs (includes enough for 10 additional acres).
Total tank mix gallons = $43.4 \times 5 = 217$ gallons plus extra = 267 gallons total tank mix.
Dye added at 2 lbs per 100 gallons tank mix.
Total dye = 6 lbs of blue #5601.
- Phase C - **Bt (NOVO Biobit HPWP) 1 lb (14.6 BIU) applied at 15 gallons per acre.**
Total acres = 43.4 acres.
Total Bt = 53 lbs (includes enough for 10 additional acres).
Total tank mix gallons = $43.4 \times 15 = 651$ gallons plus extra = 801 gallons total tank mix.
Grape dye added at 1 lb per 100 gallons tank mix.
Total dye = 8 lbs of grape #5758.
- Phase D - **Bt (NOVO Biobit XL) 0.5 gallons (24 BIU) applied at 0.5 gallons (undiluted) per acre.**
Total acres = 43.4 acres.
Total Bt = 28 gallons (includes enough for 10 additional acres).
Total tank mix gallons = $43.4 \times 0.5 = 21.7$ gallons plus 5 extra gallons = 26.7 rounded to 30 gallons total tank mix.
Black Shade R dye will be added at 2 lbs per 100 gallons.
Total dye = 1 lb of Black Shade R #5512.

APPENDICES

A. BT LABELS

B. FRANK ZALOM MEMORANDUM

C. CP NOZZLE FLOWRATE TABLE

D. DYES - SPECIFICATIONS AND MSDS

E. METHODS FOR ASSESSING DROP STAINS

F. GENERAL SITE MAP

APPENDIX A

BT LABELS



Foray™ 48B



Flowable Concentrate
Forest, Trees and Shrubs

KEEP OUT OF REACH OF CHILDREN
CAUTION

Biobit XL

If in eyes, flush with plenty of water. Get medical attention if irritation persists.

ACTIVE INGREDIENT:

Bacillus thuringiensis subsp. *kurstaki* 10,600
International Units (IU)/mg of product (equivalent
to 48 billion IU/gallon) 2.1%

INERT INGREDIENTS: 97.9%

TOTAL 100%

PRECAUTIONARY STATEMENTS: *Hazards to Humans and Domestic Animals:* May cause eye irritation. Avoid contact with skin, eyes, open wounds or clothing. Wash thoroughly with soap and water after handling.

Environmental Hazards: Do not contaminate water when disposing of equipment washwaters.

DIRECTIONS FOR USE:

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. FORAY contains the spores and endotoxin crystals of *Bacillus thuringiensis kurstaki*. FORAY is a stomach poison and has high specific activity against lepidopterous larvae. After ingestion, larvae stop feeding within hours and die 2-5 days later. Maximum activity is exhibited against early instar larvae. FORAY 48B Flowable Concentrate may be used for both ground and aerial application. The product should be shaken or stirred before use. Add some water to the tank mix, pour the recommended amount of FORAY 48B into the tank and then add the remaining amount of water to obtain the proper mix ratio. Agitate as necessary to maintain the suspension. The diluted mix should be used within 72 hours.

Ground Application: Use an adequate amount of tank mix to obtain thorough coverage without excessive run off. Use the recommended per acre dosages of FORAY 48B in the following amounts of water:

High volume hydraulic sprayers	100 gallons
Mist blowers	10 gallons

Aerial Application: FORAY 48B may be applied aerially, either alone or diluted with water at the dosages shown in the application rates table. Spray volumes of 32-128 ounces per acre are recommended. Best results are expected when FORAY 48B is applied to dry foliage.

RE-ENTRY: FORAY may be applied up to and including the day of harvest.

STORAGE AND DISPOSAL: Do not contaminate water, food or feed by storage or disposal of waste.

Storage: Store in a cool, dry place. Keep containers tightly closed when not in use. Store in temperatures above freezing and below 32 degrees C (90 degrees F).

Pesticide Disposal: Pesticide waste resulting from the use of this product may be disposed of on site or at an approved waste disposal facility in accordance with federal and local regulations.

Container Disposal: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

APPLICATION RATES:

Crop	Pests	Rate* (pts/acre)	Dosage* (BIU/Acre)
Forests, Shade Trees, Ornamentals, Shrubs, Sugar Maple Trees, Seed Orchards, Ornamental Fruit, Nut and Citrus Trees	Gypsy moth Spruce budworm, browntail moth, Douglas fir tussock moth, coneworm Tussock moths, pine butterfly, bagworm, leafrollers, tortix, mimosa webworm, tent caterpillar, jackpine budworm, black headed budworm, elm spanworm, saddled prominent, saddleback caterpillar and hemlock looper Redhumped caterpillars, spring and fall cankerworm, California oakworm, fall webworm	1.3-6 1.3-5 1-2.7 0.7-1.3	8-36 8-30 6-16 4-8

* Use the higher recommended rates on advanced larval stages or under high density larval populations.

WARRANTY NOTICE: NOVO NORDISK MAKES NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PURPOSE OR OTHERWISE, EXPRESS OR IMPLIED, concerning this product or its uses which extend beyond the use of the product under normal conditions in accord with the statements made on this label. In no case shall the seller be liable for consequential, special, or indirect damages resulting from the use or handling of this product. All such risks shall be assumed by the buyer.

EPA Registration No. 58998-7
EPA Est. No. 58998-DN-001

MANUFACTURED FOR:
Novo Nordisk
33 Turner Road
Danbury, Connecticut 06813-1907



NET CONTENT

(U.S. GALLONS)

FO48M91

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

Do not apply this product through any type of irrigation system.

Re-entry

Do not enter treated area without protective clothing until sprays have dried.

Because certain states may require more restrictive reentry intervals for various crops treated with this product, consult your State Department of Agriculture for further information.

Do not apply this product in such a manner as to directly or through drift expose workers or other persons. The area being treated must be vacated by unprotected persons.

Written or oral warnings must be given to workers who are expected to be in a treated area or in an area about to be treated with this product. Oral warnings must include the following information:

Inform workers of area of fields that must not be entered without appropriate protective clothing until sprays have dried. In case of accidental exposure, wash thoroughly with soap and water. If in eyes, flush with plenty of water. Get medical attention if eye irritation persists.

When oral warnings are given, warnings shall be given in a language customarily understood by workers. Written warnings must include the following information:

CAUTION: Area treated with Biobit HPWP on (date of application). Do not enter without appropriate protective clothing until sprays have dried. In case of accidental exposure, wash thoroughly with soap and water. If in eyes, flush with plenty of water. Get medical attention if eye irritation persists.

APPLICATION

Biobit HPWP may be applied by ground or aerial equipment with quantities of water sufficient to provide thorough coverage of plant parts to be protected. The amount of water needed per acre will depend upon crop size, weather, spray equipment, and local experience.

MIXING

Fill spray or mixing tank half full of water. Begin agitation and pour Biobit HPWP into water while maintaining continuous agitation. Add other spray material (if any) and balance of water. Agitate as necessary to maintain suspension. Do not allow diluted mixture to remain in the tank for more than 48 hours.

The use of a spreader-sticker is recommended for hard to wet crops such as cole crops or to improve weather-fastness of the spray deposits. Combinations with commonly used spray tank adjuvants are generally not deleterious to Biobit HPWP if the mix is used promptly. Before mixing in the spray tank, it is advisable to test physical compatibility by mixing all components in a small container in proportionate quantities.

APPLICATION RATES:

CROP GROUP				
FORAGE, FODDER, HAY				
	Crop	Pests	Rate (lbs./acre)	Special Instructions
	Alfalfa (Hay & Seed) and Other Non-grass Animal Feeds,	Alfalfa Caterpillar Loopers	0.25-1.0	
	Grasses Grown For Feed (pasture, ranges, hay or silage)	Armyworm	0.5-2.0	*
		European Skipper (Essex Skipper)	0.5-1.0	

CROP GROUP				
FRUITS & NUTS				
	Crop	Pests	Rate (lbs./acre)	Special Instructions
	Pome and Stone Fruit Trees such as: Apples, Pears, Quince, Apricots, Cherries, Nectarines, Peaches, Plums, Prunes. Nut Trees such as: Almonds, Filbert, Chestnuts, Walnuts, Pecans.	Redhumped Caterpillars Tent Caterpillars Omnivorous Leafroller Tortrix Moths Cankerworms Peach Twig Borer Fruittree Leafroller Gypsy Moth Tufted Apple Budmoth Fall Webworm Variegated Leafroller Redbanded Leafroller Filbert Webworm Codling Moth Cutworms Filbert Leafroller Oblique Banded Leafroller Walnut Caterpillar	0.5-2.0	
		Citrus Cutworm Roughskinned Cutworm	0.25-0.5	

CROP GROUPS				
VEGETABLES AND TUBER CROPS				
	Crop	Pests	Rate (lbs./acre)	Special Instructions
	Root & Tuber Vegetables, and leaves of Root and Tuber vegetables such as Beet, Carrot, Horseradish, Radish, Potato Sweet Potato, Turnip and Turnip Greens, Sugarbeets,	Imported Cabbageworm Green Cloverworm	0.25-1.0	
		----- Hornworms -----	0.125-1.0	-----
		Cutworms Loopers Webworms Saltmarsh Caterpillar Omnivorous Leafroller	0.5-1.0	
		----- Armyworm -----	0.5-2.0	*
		Diamondback Moth -----	0.25-2.0	-----
		European Corn Borer -----	1.0-1.5	
		Alfalfa Caterpillar	0.125- 0.25	
	Bulb Vegetables such as: Garlic, Leeks, Onions, Shallot	Saltmarsh Caterpillar Omnivorous Leafroller Webworms Cutworms -----	0.5-1.0	
		Hornworms -----	0.125-1.0	
		Imported Cabbageworm Green Cloverworm Loopers -----	0.25-1.0	
		Armyworm -----	0.5-2.0	*
		Diamondback Moth -----	0.25-2.0	
		European Corn Borer -----	1.0-1.5	
		Helicoverpa (Heliothis) sp	1.0	Suppression Only **

	Crop	Pests	Rate (lbs./acre)	Special Instructions
	Fruiting Vegetables	Imported Cabbageworm Green Cloverworm	0.25-0.5	
	such as: Eggplant, Peppers, Tomatoes	----- Diamondback Moth	----- 0.25-2.0	-----
		----- Hornworms	----- 0.125-1.0	-----
		----- Tomato Fruitworm (Heliothis) Variegated Cutworm Saltmarsh Caterpillar Loopers	----- 0.5-1.0	-----
		----- Armyworm	----- 0.5-2.0	----- *
		----- European Corn Borer	----- 1.0-1.5	-----
	Brassica (cole) vegetables such as: Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kohlrabi,	Diamondback Moth	0.25-2.0	
		----- Hornworms	----- 0.125-1.0	-----
		----- Webworms Loopers Cutworms Saltmarsh Caterpillar Omnivorous leafroller	----- 0.5-1.0	-----
		----- Imported Cabbageworm Green Cloverworm	----- 0.25-1.0	-----
		----- Armyworms	----- 0.5-2.0	----- *
		----- European Corn Borer	----- 1.0-1.5	-----
	Cucurbit vegetables such as: Cucumbers,	Imported Cabbageworm Green Cloverworm Loopers	0.25-1.0	
		----- Diamondback Moth	----- 0.25-2.0	-----
	Melons, Pumpkins, Squash, Watermelon	Saltmarsh Caterpillar Melonworm Pickleworm Rindworm complex	0.25-1.0	
		----- Armyworm	----- 0.5-2.0	----- *
		----- European Corn Borer	----- 1.0-1.5	-----
		----- Hornworms	----- 0.125-0.5	-----

CROP GROUP				
OTHER CROPS				
	Crop	Pests	Rate (lbs./acre)	Special Instructions
	Avocadoes	Loopers	1.0-1.25	
		Orange Tortrix	0.5-2.0	
		Omnivorous Leafroller		
		Omnivorous Looper		
		Spanworm		
		Amorbia	0.5-2.0	Suppression Only **
	Rice	Armyworms	0.5-1.5	*
		Loopers	0.5-1.0	
		Saltmarsh Caterpillar,		
		Cutworm	0.5-1.5	
		Green Cloverworm, VelvetBean Caterpillar	0.25-0.5	
		Helicoverpa (Heliothis) spp	1.0	Suppression Only **

	Crop	Pests	Rate (lbs./acre)	Special Instructions
	Hops	Armyworm	0.5-2.0	*
		----- Loopers	0.25-1.0	-----
		----- Omnivorous Leaf-tier Spotted Cutworm Oblique Banded Leafroller	0.5-1.0	-----
	Jojoba	Looper (Anacamptodes spp.)	0.5-1.0	
	Peanuts	Green Cloverworm Loopers Velvetbean Caterpillar Podworms	0.5-1.0	
		----- Helicoverpa (Heliothis) spp	1.0	Suppression Only **
	Persimmons, Pomegranate	Fall Webworm Filbert Webworm Omnivorous Leafroller Redhumped Caterpillar Tent Caterpillar	0.5-1.0	
		----- Citrus Cutworm	0.5-1.25	
	Safflower	Armyworm	0.5-2.0	*
		----- Loopers Saltmarsh Caterpillar	0.5-1.0	-----
	Sorghum	Headworm	0.5-1.0	
	Soybeans	(see Vegetable Crops, Legumes)		
	Sunflowers	Headmoth Loopers	0.5-1.0	
	Small Grains	Armyworms	0.5-2.0	*
		----- Loopers	0.5-1.0	-----
	Tobacco	Tobacco Hornworm	0.125-0.5	
		----- Looper	0.25-1.0	-----
		----- Tobacco Budworm	2.0	Suppression Only **

CROP GROUP				
Forests, Shade Trees, Ornamentals, Shrubs, Sugar Maple Trees				
	Crop	Pests	Rate (lbs./acre)	Special Instructions
	Forests, Shade Trees, Ornamentals, Shrubs, Sugar Maple Trees	Gypsy Moth Spruce Budworm Browntail Moth	0.5-1.25	
		----- Tussock Moths Pine Butterfly Bagworm Leafrollers Tortrix Moths Mimosa Webworm Tent Caterpillars Jackpine Budworm Blackheaded Budworm Elm Spanworm Saddled Prominent Saddleback Caterpillars	0.5-1.0	
		----- Redhumped Caterpillar Spring Cankerworm Fall Cankerworm California Oakworm Fall Webworm	0.25-0.5	

Special Instructions

* Biobit HPWP may be used to control small armyworms (first and second instar) when populations are light and full coverage sprays are applied. Repeat treatment as necessary. If mature larvae or heavy populations are present, a contact insecticide should be used to enhance control.

** Supression Only. Use to aid in control of light to moderate populations of first and second instars in integrated pest management conditions. Repeat treatments at four to five day intervals. The use of additional ovicidal or larvicidal insecticide will aid in control.

APPENDIX B

FRANK ZALOM

MEMORANDUM

UNIVERSITY OF CALIFORNIA, DAVIS

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO



SANTA BARBARA • SANTA CRUZ

STATEWIDE INTEGRATED PEST
MANAGEMENT PROJECT
(916) 752-8350
FAX: (916) 752-6004

DAVIS, CALIFORNIA 95616-8621

January 10, 1994

Bob Hennigan, Hennigan Farms, Fax: (916) 898-9341
Joe Connell, Butte County, Fax: (916) 538-7140
Jack Barry, USDA Forest Service, Davis, Fax: (916) 757-8383
Gary Kirfman, Entotech, Davis, Fax: (916) 757-4789
Jim Conley, Entotech, Davis, Fax: (916) 757-4789
Wayne Johnson, Entomology, UC Davis, Fax: (916) 752-1537

This project will take close communication, so I am including all of our Fax numbers above.

It looks like the aerial *Bt* trial at Hennigan Farms in Butte County will become a reality. As we discussed, we will have five treatments replicated four times each. The treatments are: (a) conventional dormant OP spray applied in January by applicator and arranged by Mr. Hennigan (dilution, release height and nozzles at discretion of applicator), (b) 1.0 lb. (14.6 BIU) Blobit HP applied at five gallons per acre with release height of 20 feet using nozzle configuration recommended by Jack Barry at popcorn and petalfall, (c) 1.0 lb. (14.6 BIU) Blobit HP applied at 15 gallons per acre with release height of 20 feet using nozzle configuration recommended by Jack Barry at popcorn and petalfall, (d) 14.6 BIU equivalent (check with Gary & Jim) Blobit XL (if RUP is issued) applied at 0.5 or 1.0 gallons per acre with release height of 20 feet using Micronaire atomizers with configuration recommended by Jack Barry at popcorn and petalfall, (e) untreated control.

The experimental design will be four complete blocks of all five treatments in separate blocks of the Hennigan Farms orchard. All applications will be made in north/south swaths with a treatment width of 20 trees, except in Block 1 (on map 1) which will have a treatment width of 15 trees, and Block 4 (on map 1) which will have the conventional dormant treatment, (a) above, applied to a width of 40 trees and the other four treatments to widths of 20 trees. The Crowder Block (map 2) will be divided in half at the power lines which transect the block. Each half will be treated as separate blocks. Please look over the plot maps. I assigned them at random (except the untreated in the Crowder Block due to power lines), and they can be changed as needed.

Dormant spray: The dormant treatment will be arranged by Mr. Hennigan. We will need to know prior to application the scheduled date of the application so that we can monitor the treatment. Long PVC poles (two per tree in five trees in each treatment) will be placed in the dormant treatment and the untreated treatment. Short (18" height) PVC poles (two per tree by five trees in each treatment) will be placed in the aisles by the same trees. The long poles (80 total) will be provided by Gary or Jim. The short poles will be provided by me. Empty cans with cards (provided by Jack) to monitor deposition will be placed at the top of the long and short poles. The area of each card covered by the spray will be determined.

January 10, 1994

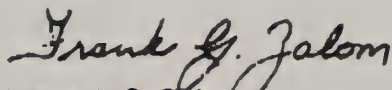
Page 2

Bt sprays: The Bt sprays will be coordinated with Mr. Hennigan and Jack Barry. If Blobit XL is to be used, an experimental use permit will have to be obtained first (Gary will check on this). The treatments will be as described above. Joe and Mr. Hennigan will have to determine the times for the popcorn and petalfall sprays; and will let us know before the time of the treatments when they will be applied so that we can set up the monitoring. We may try to do this the afternoon before the trial. As in the dormant spray trial, two long and two short poles per tree will be placed by five trees in each of the three Bt treatments and the untreated control. The long poles (160 total) will be provided by Gary or Jim and may include ones from the previous trial. The short poles will be provided by me. Empty cans with cards (provided by Jack) to monitor deposition will be placed at the top of the long and short poles. The area of each card covered by the spray will be determined. Three colors of dye will be placed in the Bt treatments so that we can determine if drift occurred onto the other plots.

After the popcorn spray and by very early March, we will band ten trees (scaffold or trunks) with corrugated cardboard. The bands will be removed in early April before the first moths are caught in pheromone traps. The bands will be returned to Davis, dissected and the number of peach twig borer pupae determined.

Let me know if what I have described sounds like what we had discussed.

Sincerely,


Frank G. Zalom (sr)

FGZ/sr
Enclosures

UNIVERSITY OF CALIFORNIA, DAVIS

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SANTA BARBARA • SANTA CRUZ

STATEWIDE INTEGRATED PEST
MANAGEMENT PROJECT
TELEPHONE (916) 752-8350
FACSIMILE (916) 752-6004

DAVIS, CALIFORNIA 95616-8621

FACSIMILE COVER SHEET

Total number of pages (including this cover sheet) 3

To:

Bob Hennigan

FAX number:

(916) 898-9341Joe Connell(916) 538-7140Jack Barry(916) 757-8383Gary Kirfman(916) 757-4789James Conley(916) 757-4789Wayne Johnson(916) 752-1537From: Dr. Frank G. ZalomFAX number: (916) 752-6004Dept: Statewide IPM ProjectPhone number: (916) 752-8350

Delivery Instructions:

☐

Confidential

☒

Addressee is expecting FAX; notify or deliver immediately

☐

Notify or deliver immediately

☐

Routine

Messages:

Notify secretary at (916) 752-8350 if there are problems with this transmission.

APPENDIX C

CP NOZZLE

FLOWRATE TABLE

Plastic Nozzle Flow Rate

(Nylon)

Pressure (PSI)	Orifice Size			
	.062	.078	.125	.172
10	0.352	0.552	1.254	1.585
20	0.462	0.722	1.654	2.255
30	0.572	0.892	2.054	2.925
40	0.682	1.062	2.454	3.369

Nozzle
w/ 20 lbs
better
than
stainless
steel

Stainless Steel Nozzle Flow Rate

Pressure (PSI)	Orifice Size			
	.062	.078	.125	.172
10	0.335	0.500	1.012	1.334
20	0.435	0.650	1.332	1.774
30	0.535	0.800	1.652	2.214
40	0.635	0.950	1.972	2.575

Formula**For Number of Nozzles Needed**

1. Determine Acres Per Minute
(M.P.H. x Swath Width, divided by 495 = A.P.M.)
2. Determine Total Gallons Per Minute
(A.P.M. x Gallons Per Acre requested. . . 1, 2, 3, 5 etc. per acre)
Example: A.P.M. x 3 = T.G.P.M.
3. Determine Nozzles Required
(T.G.P.M. divided by orifice of choice with
desired pressure = Nozzles Required)

Sample:

Conditions: 120 M.P.H., 70 ft. Swath, 3 Gal/Acre
Plastic Orifice Size 0.125, PSI 20 lbs.

$$120 \times 70 \div 495 \times 3 \div 1.654 \\ = 30.779376 \text{ or } 30 \text{ or } 31 \text{ Nozzles}$$

Distributed By:

APPENDIX D

DYES - SPECIFICATIONS

AND MSDS

PRODUCT SPECIFICATION

NO. 7700 FD&C RED #40

DESCRIPTION:

A reddish-brown water soluble powder with characteristic hue when dissolved and viewed in a 10 ppm water solution.

PURE DYE:

Not less than 89%. Range 89-93%.

IDENTIFICATION:

A 10 ppm solution buffered with 9 grams per liter of ammonium acetate compares favorably with the accepted standard prepared likewise using any spectrophotometer, colorimeter or visual method.

10 ppm solutions should be prepared by first making 1.00% w/v aqueous solutions and then diluting 1:1000 v/v with purified water.

PACKAGING:

This product is packaged in one, five and twenty-five pound plastic containers, and in one-hundred pound fibre drums. Custom packaging is available upon request at an additional cost.

STORAGE:

Product should be kept in closed container at ambient temperature and humidity.

SHELF LIFE:

Indefinite if kept under recommended storage conditions.

FDA STATUS:

This product is approved by the FDA and meets the specifications outlined in the Code of Federal Regulations, Title 21, Parts 74 and 82.

This information is provided for documentation purposes only. This product is not considered hazardous.

Warner-Jenkinson Company, Inc.
2526 Baldwin Street
St. Louis, MO 63106
800/824-7022, ext. 7443

M A T E R I A L S A F E T Y D A T A S H E E T

DATE PREPARED: 6/93 REVISION DATE: Original CHEMIST INITIALS: BDM

S E C T I O N I - P R O D U C T I D E N T I F I C A T I O N

PRODUCT CODE & DESCRIPTION: No. 7700 FD&C Red #40

TECHNICAL NAME: Not applicable.

SYNONYMS: Color Additive

CLASSIFICATION CODE: Not hazardous.

PRODUCT CAS NOS. (NEW JERSEY COMPLIANCE): 25956-17-6

S E C T I O N I I - H A Z A R D O U S I N G R E D I E N T (S)

None of the ingredients of this material meet the definition of "Hazardous Chemical", 29 CFR 1910.1200.

S E C T I O N I I I - P H Y S I C A L D A T A

MELTING POINT (°C): Not applicable.

SOLUBILITY IN WATER: Soluble.

FLASH POINT (METHOD): Not applicable.

% VOLATILE BY VOLUME: Not applicable.

pH (as is): Not applicable.

APPEARANCE AND ODOR: A dry colorant.

S E C T I O N I V - F I R E A N D E X P L O S I O N
H A Z A R D D A T A

EXTINGUISHING MEDIA: Water, chemical foam, or dry chemical extinguisher.

SPECIAL FIRE FIGHTING PROCEDURES: None.

UNUSUAL FIRE AND EXPLOSION HAZARD: None.

CSL: D/DB

S E C T I O N V - R E A C T I V I T Y D A T A

STABILITY: Under normal storage and handling conditions, this is a stable material when kept in a closed container.

MATERIALS/CONDITIONS TO AVOID: None.

HAZARDOUS DECOMPOSITION PRODUCTS: None.

HAZARDOUS POLYMERIZATION: Will not occur.

S E C T I O N V I - H E A L T H H A Z A R D D A T A

INGESTION: None.

EYE CONTACT: None.

INHALATION: None.

OTHER EFFECTS: None.

SKIN CONTACT: None.

S E C T I O N V I I - E M E R G E N C Y F I R S T A I D P R O C E D U R E S

SKIN: No adverse effects. Wash skin with mild soap and water to remove nuisance color. Some dyes may temporarily stain skin.

INGESTION: If large quantities are ingested, consult your physician.

INHALATION: This product is not classified as an irritant, however, dry powder dust may cause irritation in some individuals.

EYES: This product is not classified as an irritant. If exposed, wash the eyes with large amounts of water, occasionally lifting the lower and upper lids; continue for 15 minutes. If irritation develops, seek medical attention.

S E C T I O N V I I I - P E R S O N A L P R O T E C T I O N

EYES: Eye protection is suggested for compliance with Good Manufacturing Practices. (GMP)

VENTILATION: This product can generate dust. Ventilation or dust collection would be helpful, but not necessary.

RESPIRATORY: No respiratory protection required, but dust masks are suggested.

OTHER PROTECTIVE EQUIPMENT: None required. To minimize clean-up, wear gloves when handling material.

WORK/HYGIENIC PRACTICES: Some dyes may temporarily stain skin. Use good personal hygiene practices; limit exposure to product whenever possible to minimize clean-up.

S E C T I O N I X - S P I L L O R L E A K P R O C E D U R E S

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: If dry; shovel, vacuum, or sweep color up for disposal. If wet, surfaces exposed to a spill may become slippery or sticky. Spills should be thoroughly flushed with soapy water until all apparent color is removed.

WASTE DISPOSAL METHOD: Sanitary landfill in accordance with Local, State and Federal regulations.

S E C T I O N X - S T O R A G E A N D H A N D L I N G

Store in a tightly sealed container.

See specification for other product characteristics.

MATERIAL SAFETY DATA SHEET PREPARED BY WARNER-JENKINSON COMPANY, INC.,
DIVISION OF UNIVERSAL FOODS CORPORATION.

For additional information on this product, call (800) 824-7022, ext. 7443 during normal business hours.

CSL: D/DB

Warner-Jenkinson Company, Inc.
2526 Baldwin Street
P.O. Box 14538
St. Louis, Missouri 63178-4538, U.S.A.

PRODUCT SPECIFICATION

No. 6503 FD&C GREEN #3
(Fast Green FCF)

DESCRIPTION:

A water soluble powder with a characteristic hue when dissolved and viewed in a 10 ppm water solution.

PURE DYE:

Not less than 89%. Range 89-93%.

IDENTIFICATION:

A 10 ppm solution buffered with 9 grams per liter of ammonium acetate compares favorably with the accepted standard prepared likewise using any spectrophotometer, colorimeter or visual method.

10 ppm solutions should be prepared first by making 1.00% w/v aqueous solutions and then diluting 1:1000 v/v with purified water.

PACKAGING:

This product is packaged in one, five and twenty-five pound plastic containers and in one-hundred pound fiber drums. Custom packaging is available upon request at an additional cost.

STORAGE:

Product should be kept in closed container at ambient temperature and humidity.

SHELF LIFE:

Indefinite if kept under recommended storage conditions.

FDA STATUS:

This product is approved by the FDA and meets the specifications outlined in the Code of Federal Regulations, Title 21, Parts 74 and 82.


DSF
5/91

A subsidiary of
UNIVERSAL *foods* CORPORATION

Customer/Technical Service: 1-800-325-8110

Technical Service Fax: 1-314-658-7314

Customer Service Fax: 1-314-658-7318

This information is provided for documentation purposes only. This product is not considered hazardous.

Warner-Jenkinson Company, Inc.
2526 Baldwin Street
St. Louis, MO 63106
800/824-7022, ext. 7443

M A T E R I A L S A F E T Y D A T A S H E E T

DATE PREPARED: 6/93 REVISION DATE: Original CHEMIST INITIALS: BMM

S E C T I O N I - P R O D U C T I D E N T I F I C A T I O N

PRODUCT CODE & DESCRIPTION: No. 6503 FD&C Green #3

TECHNICAL NAME: Not applicable.

SYNONYMS: Color Additive

CLASSIFICATION CODE: Not hazardous.

PRODUCT CAS NOS. (NEW JERSEY COMPLIANCE): 2353-45-9

S E C T I O N I I - H A Z A R D O U S I N G R E D I E N T (S)

None of the ingredients of this material meet the definition of "Hazardous Chemical", 29 CFR 1910.1200.

S E C T I O N I I I - P H Y S I C A L D A T A

MELTING POINT (°C): Not applicable.

SOLUBILITY IN WATER: Soluble.

FLASH POINT (METHOD): Not applicable.

% VOLATILE BY VOLUME: Not applicable.

pH (as is): Not applicable.

APPEARANCE AND ODOR: A dry colorant.

S E C T I O N I V - F I R E A N D E X P L O S I O N
H A Z A R D D A T A

EXTINGUISHING MEDIA: Water, chemical foam, or dry chemical extinguisher.

SPECIAL FIRE FIGHTING PROCEDURES: None.

UNUSUAL FIRE AND EXPLOSION HAZARD: None.

CSL: D/DB

SECTION V - REACTIVITY DATA

STABILITY: Under normal storage and handling conditions, this is a stable material when kept in a closed container.

MATERIALS/CONDITIONS TO AVOID: None.

HAZARDOUS DECOMPOSITION PRODUCTS: None.

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION VI - HEALTH HAZARD DATA

INGESTION: None.

EYE CONTACT: None.

INHALATION: None.

OTHER EFFECTS: None.

SKIN CONTACT: None.

SECTION VII - EMERGENCY FIRST AID PROCEDURES

SKIN: No adverse effects. Wash skin with mild soap and water to remove nuisance color. Some dyes may temporarily stain skin.

INGESTION: If large quantities are ingested, consult your physician.

INHALATION: This product is not classified as an irritant, however, dry powder dust may cause irritation in some individuals.

EYES: This product is not classified as an irritant. If exposed, wash the eyes with large amounts of water, occasionally lifting the lower and upper lids; continue for 15 minutes. If irritation develops, seek medical attention.

SECTION VIII - PERSONAL PROTECTION

EYES: Eye protection is suggested for compliance with Good Manufacturing Practices. (GMP)

VENTILATION: This product can generate dust. Ventilation or dust collection would be helpful, but not necessary.

RESPIRATORY: No respiratory protection required, but dust masks are suggested.

OTHER PROTECTIVE EQUIPMENT: None required. To minimize clean-up, wear gloves when handling material.

WORK/HYGIENIC PRACTICES: Some dyes may temporarily stain skin. Use good personal hygiene practices; limit exposure to product whenever possible to minimize clean-up.

S E C T I O N I X - S P I L L O R L E A K P R O C E D U R E S

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: If dry; shovel, vacuum, or sweep color up for disposal. If wet, surfaces exposed to a spill may become slippery or sticky. Spills should be thoroughly flushed with soapy water until all apparent color is removed.

WASTE DISPOSAL METHOD: Sanitary landfill in accordance with Local, State and Federal regulations.

S E C T I O N X - S T O R A G E A N D H A N D L I N G

Store in a tightly sealed container.

See specification for other product characteristics.

MATERIAL SAFETY DATA SHEET PREPARED BY WARNER-JENKINSON COMPANY, INC.,
DIVISION OF UNIVERSAL FOODS CORPORATION.

For additional information on this product, call (800) 824-7022, ext. 7443 during normal business hours.

CSL: D/DB

PRODUCT SPECIFICATION

NO. 5601 FD&C BLUE #1

Brilliant Blue

DESCRIPTION:

A metallic blue, water soluble powder with a characteristic hue when dissolved and viewed in a 10 ppm water solution.

PURE DYE:

Not less than 89% pure dye. Range 89-93%.

IDENTIFICATION:

A 10 ppm solution buffered with 9 grams per liter of ammonium acetate compares favorably with the accepted standard prepared likewise using any spectrophotometer, colorimeter or visual method.

10 ppm solutions should be prepared by first making 1.00% w/v aqueous solutions and then diluting 1:1000 v/v with purified water.

PACKAGING:

This product is packaged in one, five and twenty-five pound plastic containers, and in 100 pound fiber drums. Custom packaging is available upon request at additional cost.

STORAGE:

Product should be kept in closed container, at ambient temperature and humidity.

SHELF LIFE:

Indefinite if kept under recommended storage conditions.

FDA STATUS:

This product is approved by the FDA, and meets the specifications outlined in the Code of Federal Regulations, Title 21, Parts 74 and 82.

This information is provided for documentation purposes only. This product is not considered hazardous.

Warner-Jenkinson Company, Inc.
2526 Baldwin Street
St. Louis, MO 63106
800/824-7022, ext. 7443

M A T E R I A L S A F E T Y D A T A S H E E T

DATE PREPARED: 6/93 REVISION DATE: Original CHEMIST INITIALS: ~~EXA~~

S E C T I O N I - P R O D U C T I D E N T I F I C A T I O N

PRODUCT CODE & DESCRIPTION: No. 5601 FD&C Blue #1

TECHNICAL NAME: Not applicable.

SYNONYMS: Color Additive

CLASSIFICATION CODE: Not hazardous.

PRODUCT CAS NOS. (NEW JERSEY COMPLIANCE): 3844-45-9

S E C T I O N I I - H A Z A R D O U S I N G R E D I E N T (S)

None of the ingredients of this material meet the definition of "Hazardous Chemical", 29 CFR 1910.1200.

S E C T I O N I I I - P H Y S I C A L D A T A

MELTING POINT (°C): Not applicable.

SOLUBILITY IN WATER: Soluble.

FLASH POINT (METHOD): Not applicable.

% VOLATILE BY VOLUME: Not applicable.

pH (as is): Not applicable.

APPEARANCE AND ODOR: A dry colorant.

S E C T I O N I V - F I R E A N D E X P L O S I O N
H A Z A R D D A T A

EXTINGUISHING MEDIA: Water, chemical foam, or dry chemical extinguisher.

SPECIAL FIRE FIGHTING PROCEDURES: None.

UNUSUAL FIRE AND EXPLOSION HAZARD: None.

CSL: D/DB

SECTION V - REACTIVITY DATA

STABILITY: Under normal storage and handling conditions, this is a stable material when kept in a closed container.

MATERIALS/CONDITIONS TO AVOID: None.

HAZARDOUS DECOMPOSITION PRODUCTS: None.

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION VI - HEALTH HAZARD DATA

INGESTION: None.

EYE CONTACT: None.

INHALATION: None.

OTHER EFFECTS: None.

SKIN CONTACT: None.

SECTION VII - EMERGENCY FIRST AID PROCEDURES

SKIN: No adverse effects. Wash skin with mild soap and water to remove nuisance color. Some dyes may temporarily stain skin.

INGESTION: If large quantities are ingested, consult your physician.

INHALATION: This product is not classified as an irritant, however, dry powder dust may cause irritation in some individuals.

EYES: This product is not classified as an irritant. If exposed, wash the eyes with large amounts of water, occasionally lifting the lower and upper lids; continue for 15 minutes. If irritation develops, seek medical attention.

SECTION VIII - PERSONAL PROTECTION

EYES: Eye protection is suggested for compliance with Good Manufacturing Practices. (GMP)

VENTILATION: This product can generate dust. Ventilation or dust collection would be helpful, but not necessary.

RESPIRATORY: No respiratory protection required, but dust masks are suggested.

OTHER PROTECTIVE EQUIPMENT: None required. To minimize clean-up, wear gloves when handling material.

WORK/HYGIENIC PRACTICES: Some dyes may temporarily stain skin. Use good personal hygiene practices; limit exposure to product whenever possible to minimize clean-up.

S E C T I O N I X - S P I L L O R L E A K P R O C E D U R E S

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: If dry; shovel, vacuum, or sweep color up for disposal. If wet, surfaces exposed to a spill may become slippery or sticky. Spills should be thoroughly flushed with soapy water until all apparent color is removed.

WASTE DISPOSAL METHOD: Sanitary landfill in accordance with Local, State and Federal regulations.

S E C T I O N X - S T O R A G E A N D H A N D L I N G

Store in a tightly sealed container.

See specification for other product characteristics.

MATERIAL SAFETY DATA SHEET PREPARED BY WARNER-JENKINSON COMPANY, INC.,
DIVISION OF UNIVERSAL FOODS CORPORATION.

For additional information on this product, call (800) 824-7022, ext. 7443 during normal business hours.

CSL: D/DB

Warner-Jenkinson Company, Inc.
2526 Baldwin Street
P.O. Box 14538
St. Louis, Missouri 63178-4538, U.S.A.

PRODUCT SPECIFICATION

NO. 5758 GRAPE SHADE "R" S.D.

DESCRIPTION:

A water soluble powder containing:

FD&C Blue #1

FD&C Red #40

PURE DYE:

Not less than 89%.

IDENTIFICATION:

A 10 ppm solution buffered with 9 grams per liter of ammonium acetate compares favorably with the accepted standard prepared likewise using any spectrophotometer, colorimeter or visual method.

10 ppm solutions should be prepared first by making 1.00% w/v aqueous solutions and then diluting 1:1000 v/v with purified water.

PACKAGING:

This product is packaged in one, five and twenty-five pound plastic containers and in one-hundred pound fiber drums. Custom packaging is available upon request at an additional cost.

STORAGE:

Product should be kept in closed container at ambient temperature and humidity.

SHELF LIFE:

Indefinite if kept under recommended storage conditions.

FDA STATUS:

This product is approved by the FDA and meets the specifications outlined in the Code of Federal Regulations, Title 21, Parts 74 and 82.

DF
1/91

A subsidiary of
UNIVERSAL *Foods* CORPORATION

Customer/Technical Service: 1-800-325-8110

Technical Service Fax: 1-314-658-7314

Customer Service Fax: 1-314-658-7318

MATERIAL SAFETY DATA SHEET

I PRODUCT IDENTIFICATION

MANUFACTURER'S NAME WARNER-JENKINSON COMPANY

REGULAR TELEPHONE NO. (314) 658-7440
EMERGENCY TELEPHONE NO.

ADDRESS 2526 BALDWIN STREET, ST. LOUIS, MISSOURI 63106

TRADE NAME No. 5758 GRAPE SHADE "R" S.D.

SYNONYMS

SHIPPING
NAME¹

DOT: n/a

IATA: n/a

II HAZARDOUS INGREDIENTS²

MATERIAL OR COMPONENT

CAS NO.

%

HAZARD DATA

n/a

FD&C Colors are not considered hazardous material.

They do not fall under the jurisdiction of D.O.T.

III PHYSICAL DATA

BOILING POINT, 760 MM HG

n/a

MELTING POINT

n/a

SPECIFIC GRAVITY (H₂O = 1)

n/a

VAPOR PRESSURE

n/a

VAPOR DENSITY (AIR = 1)

n/a

SOLUBILITY IN H₂O % BY WT. GREATER THAN 1%

% VOLATILES BY VOL.

n/a

EVAPORATION RATE (BUTYL ACETATE = 1)

n/a

APPEARANCE AND ODOR

see specification

Ph (AS IS)

Ph (1% SOLN.)

n/a

IV FIRE AND EXPLOSION DATA

FLASH POINT
(TEST METHOD)

n/a

AUTOIGNITION
TEMPERATURE

n/a

FLAMMABLE LIMITS IN AIR, % BY VOL.

LOWER

n/a

UPPER

n/a

EXTINGUISHING
MEDIA

WILL NOT BURN

SPECIAL FIRE
FIGHTING
PROCEDURES

n/a

UNUSUAL FIRE
AND EXPLOSION
HAZARD

n/a

V HEALTH HAZARD INFORMATION

HEALTH HAZARD DATA	HAZARD CLASSIFICATION	BASIS FOR CLASSIFICATION	SOURCE
ROUTES OF EXPOSURE			
INHALATION	n/a		
SKIN CONTACT	n/a		
SKIN ABSORPTION	n/a		
EYE CONTACT	n/a		
INGESTION	n/a		

EFFECTS OF OVEREXPOSURE

ACUTE OVEREXPOSURE NO EFFECTS

CHRONIC OVEREXPOSURE n/a

EMERGENCY AND FIRST AID PROCEDURES

EYES: n/a

SKIN: n/a

INHALATION: n/a

INGESTION: n/a

NOTES TO PHYSICIAN

VI REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY

INCOMPATIBILITY

n/a

HAZARDOUS DECOMPOSITION PRODUCTS

n/a

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION

WILL NOT OCCUR

VII DISPOSAL, SPILL OR LEAK PROCEDURES

AQUATIC TOXICITY (E.G. 96 HR. TLM):

n/a

WASTE DISPOSAL METHOD

WILL NOT BURN - SUGGEST SANITARY LANDFILL IN ACCORDANCE
WITH LOCAL, STATE AND FEDERAL REGULATIONS.

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

CLEAN UP WITH WARM WATER AND HYPOCHLORITE BLEACH.

NEUTRALIZING CHEMICALS

n/a

VIII SPECIAL PROTECTION INFORMATION

VENTILATION REQUIREMENTS

THIS PRODUCT TENDS TO BE DUSTY. VENTILATION OR DUST COLLECTING
WOULD BE HELPFUL, BUT NOT NECESSARY.

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY (SPECIFY IN DETAIL)

EYE

n/a

GLOVES

n/a

OTHER CLOTHING AND EQUIPMENT COLOR STAINS ARE AGGRAVATING BUT NOT HAZARDOUS.

ANY PROTECTION FROM COLOR DUST IS GENERALLY APPRECIATED BY
EMPLOYEE.

IX SPECIAL PRECAUTIONS

PRECAUTIONARY
STATEMENTS

NOT NECESSARY

OTHER HANDLING AND
STORAGE REQUIREMENTS

STORE AT AMBIENT TEMPERATURE TIGHTLY SEALED.

ADDITIONAL REGULATORY CONCERNS

FEDERAL: SEE ATTACHED SPECIFICATION.

FDA

USDA

CPSC

TSCA IS THIS PRODUCT, OR ALL ITS INGREDIENTS; BEING CERTIFIED FOR INCLUSION ON THE TOXIC SUBSTANCES CONTROL ACT
INVENTORY OF CHEMICAL SUBSTANCES? YES

OTHER

STATE:

PREPARED BY HARRY MEGGOS

TITLE: _____

COMPANY: WARNER-JENKINSON COMPANY

ADDRESS: 2526 BALDWIN STREET, ST. LOUIS, MO 63106

WARNER JENKINSON

Warner-Jenkinson Company, Inc.
2526 Baldwin Street
P.O. Box 14538
St. Louis, Missouri 63178-4538, U.S.A.

PRODUCT SPECIFICATION

NO. 5512 BLACK SHADE "R"

DESCRIPTION: A water soluble powder containing:

FD&C Red #40
FD&C Blue #1
FD&C Yellow #5

PURE DYE: Not less than 90%.

IDENTIFICATION: A 10 ppm solution buffered with 9 grams per liter of ammonium acetate compares favorably with the accepted standard prepared likewise using any spectrophotometer, colorimeter or visual method.

10 ppm solutions should be prepared first by making 1.00% w/v aqueous solutions and then diluting 1:1000 v/v with purified water.

PACKAGING: This product is packaged in one, five and twenty-five pound plastic containers and in one-hundred pound fiber drums. Custom packaging is available upon request at an additional cost.

STORAGE: Product should be kept in closed container at ambient temperature and humidity.

SHELF LIFE: Indefinite if kept under recommended storage conditions.

FDA STATUS: This product is approved by the FDA and meets the specifications outlined in the Code of Federal Regulations, Title 21, Part 74.

CSL
4/93/b

THIS INFORMATION IS PROVIDED FOR DOCUMENTATION PURPOSES ONLY. THIS
PRODUCT IS NOT CONSIDERED HAZARDOUS.

Warner-Jenkinson Company, Inc.
2526 Baldwin Street
St. Louis, MO 63106
800/824-7022

M A T E R I A L S A F E T Y D A T A S H E E T

For additional information on this product, call (800) 824-7022, ext. 7443 during normal business hours.

S E C T I O N I - P R O D U C T I D E N T I F I C A T I O N

PRODUCT NAME: No. 5512 Black Shade "R"

SYNONYMS: Color Additive

CLASSIFICATION CODE: Not hazardous.

PRODUCT CAS NOS. (NEW JERSEY COMPLIANCE): 25956-17-6, 3844-45-9, 1934-21-0

S E C T I O N I I - H A Z A R D O U S I N G R E D I E N T (S)

None of the ingredients of this material meet the definition of "Hazardous Chemical", 29 CFR 1910.1200.

S E C T I O N I I I - P H Y S I C A L D A T A

MELTING POINT (°C): Not applicable.

SOLUBILITY IN WATER: Soluble.

FLASH POINT (METHOD): Not applicable.

% VOLATILE BY VOLUME: Not applicable.

pH (as is): Not applicable.

APPEARANCE AND ODOR: A dry powdered or granulated colorant.

Date prepared: 10/92
Last review date: Original

CSL

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

EXTINGUISHING MEDIA: Water, chemical foam, or dry chemical extinguisher.

SPECIAL FIRE FIGHTING PROCEDURES: None.

UNUSUAL FIRE AND EXPLOSION HAZARD: None.

SECTION V - REACTIVITY DATA

STABILITY: Under normal storage and handling conditions, this is a stable material when kept in a closed container.

MATERIALS/CONDITIONS TO AVOID: None.

HAZARDOUS DECOMPOSITION PRODUCTS: None.

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION VI - HEALTH HAZARD DATA

INGESTION: N/A

INHALATION: N/A

SKIN CONTACT: N/A

EYE CONTACT: N/A

OTHER EFFECTS: None

SECTION VII - EMERGENCY FIRST AID PROCEDURES

SKIN: No adverse effects. Wash skin with mild soap and water to remove nuisance color. Some dyes may temporarily stain skin.

INGESTION: If large quantities are ingested, consult your physician.

INHALATION: This product is not classified as an irritant, however, dry powder dust may cause irritation in some individuals.

EYES: This product is not classified as an irritant. If exposed, wash the eyes with large amounts of water, occasionally lifting the lower and upper lids; continue for 15 minutes. If irritation develops, seek medical attention.

SECTION VIII - PERSONAL PROTECTION

EYES: Eye protection is suggested for compliance with Good Manufacturing Practices. (GMP)

VENTILATION: This product can generate dust. Ventilation or dust collection would be helpful, but not necessary.

RESPIRATORY: No respiratory protection required, but dust masks are suggested.

OTHER PROTECTIVE EQUIPMENT: None required. To minimize clean-up, wear gloves when handling material.

WORK/HYGIENIC PRACTICES: Some dyes may temporarily stain skin. Use good personal hygiene practices; limit exposure to product whenever possible to minimize clean-up.

SECTION IX - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:
If dry; shovel, vacuum, or sweep color up for disposal. If wet, surfaces exposed to a spill may become slippery or sticky. Spills should be thoroughly flushed with soapy water until all apparent color is removed.

WASTE DISPOSAL METHOD: Sanitary landfill in accordance with Local, State and Federal regulations.

SECTION X - STORAGE AND HANDLING

Store in a tightly sealed container.

See specification for other product characteristics.

MATERIAL SAFETY DATA SHEET PREPARED BY WARNER-JENKINSON COMPANY, INC., DIVISION OF UNIVERSAL FOODS CORPORATION.

CSL

APPENDIX E

METHODS FOR

ASSESSING DROP STAINS

Appendix E

11 February 1994

Method for Assessing Drop Stains on Kromekote Cards Used as Sampling Substrate on Sides of Soft Drink Cans. The objective of this method is to produce a relative index per sampler that reflects percent coverage on the soft drink can sampler and factors in drop stain density.

1. Divide the $4 \frac{5}{16} \times 8 \frac{3}{16}$ card, perpendicularly to its longitudinal axis and divide into 4 segment units measuring approximately 2.05 inches each. A hard lead pencil can be used. The first segment line should divide the most dense drop stains from the least dense (see figures 1 & 2). From that reference line measure 2.05 inches and draw lines.
2. Assess the size and number of drop stains in the approximate middle of each segment being careful to avoid smeared drop stains and lines from rubber bands used to secure the card to sides of the cans. The area to be assessed depends upon drop density with a rule of thumb that if any drop stains are visible in a segment the size of the counting area of the segment counted should produce a total count of at least 5 drop stains, noting that the average drop stains per square centimeters could be for less than 5 per square centimeters.
3. Average the numbers of drop stains per segment and then calculate the mean of these four averages. The result is mean drop stains per card. If there are no drop stains observed in a segment the 0 will nevertheless be included in computing the mean.
4. Another desirable assessment is the percent of the card that is covered by stains, weighted by the drop stain density of each segment. This number becomes important when evaluating tree coverage, eg. helicopter vs fixed wing or slow flying aircraft vs faster flying aircraft or one canopy type to another. For this percent of card covered I have devised an equation. The results produced by steps 1-3 above provides the necessary elements for input to the equation. I might have to modify the equation later to compensate for the high drop stain density that usually occurs in one of the segments and tends to bias the data. The concern here is the over weighted value from one segment might compromise the relative index.

5. A proposed approach for the relative index equation that integrates both the drop stain density and percent of the can sampler that contains drop stains (percent coverage) is as follows:

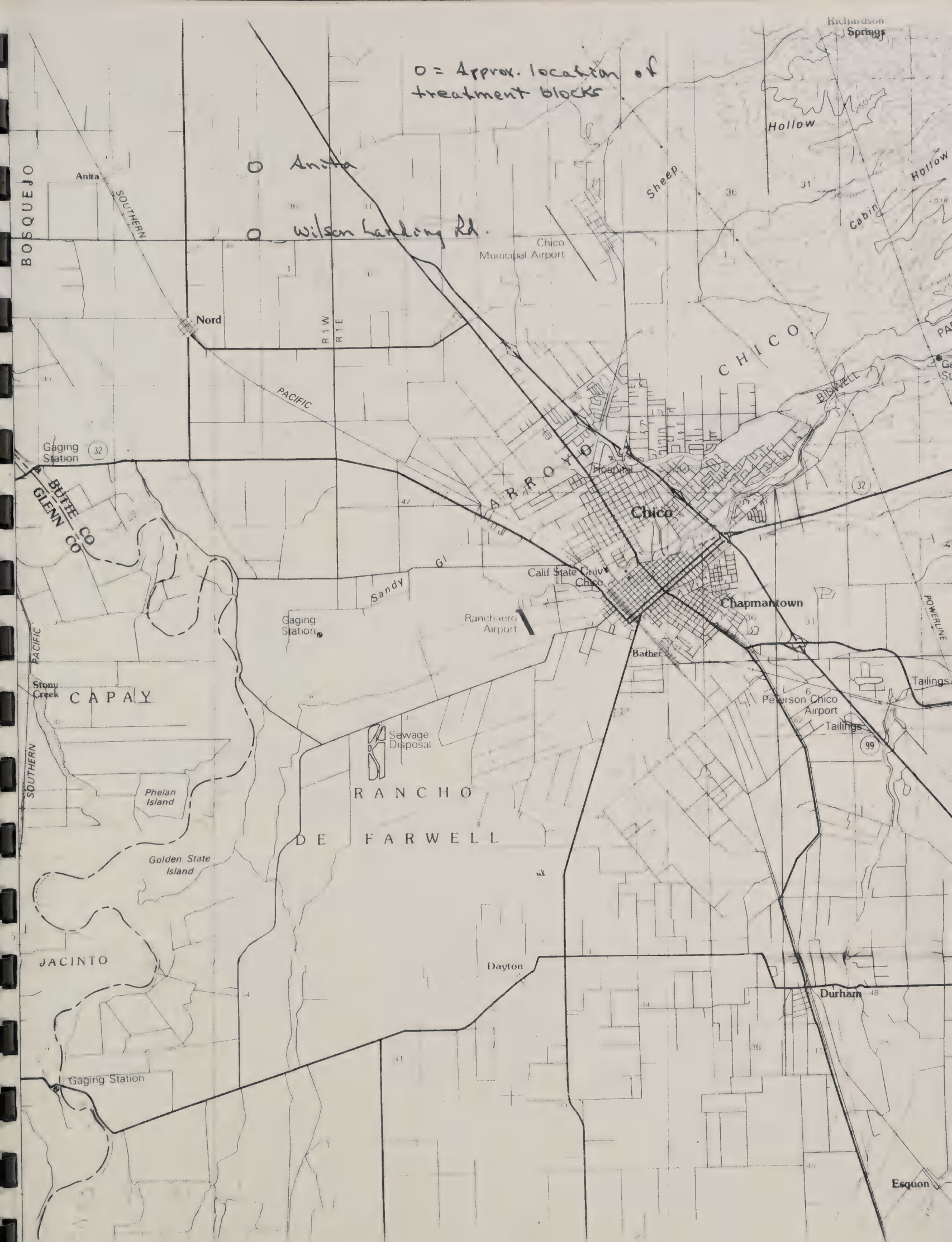
Relative Index for Coverage (RI)

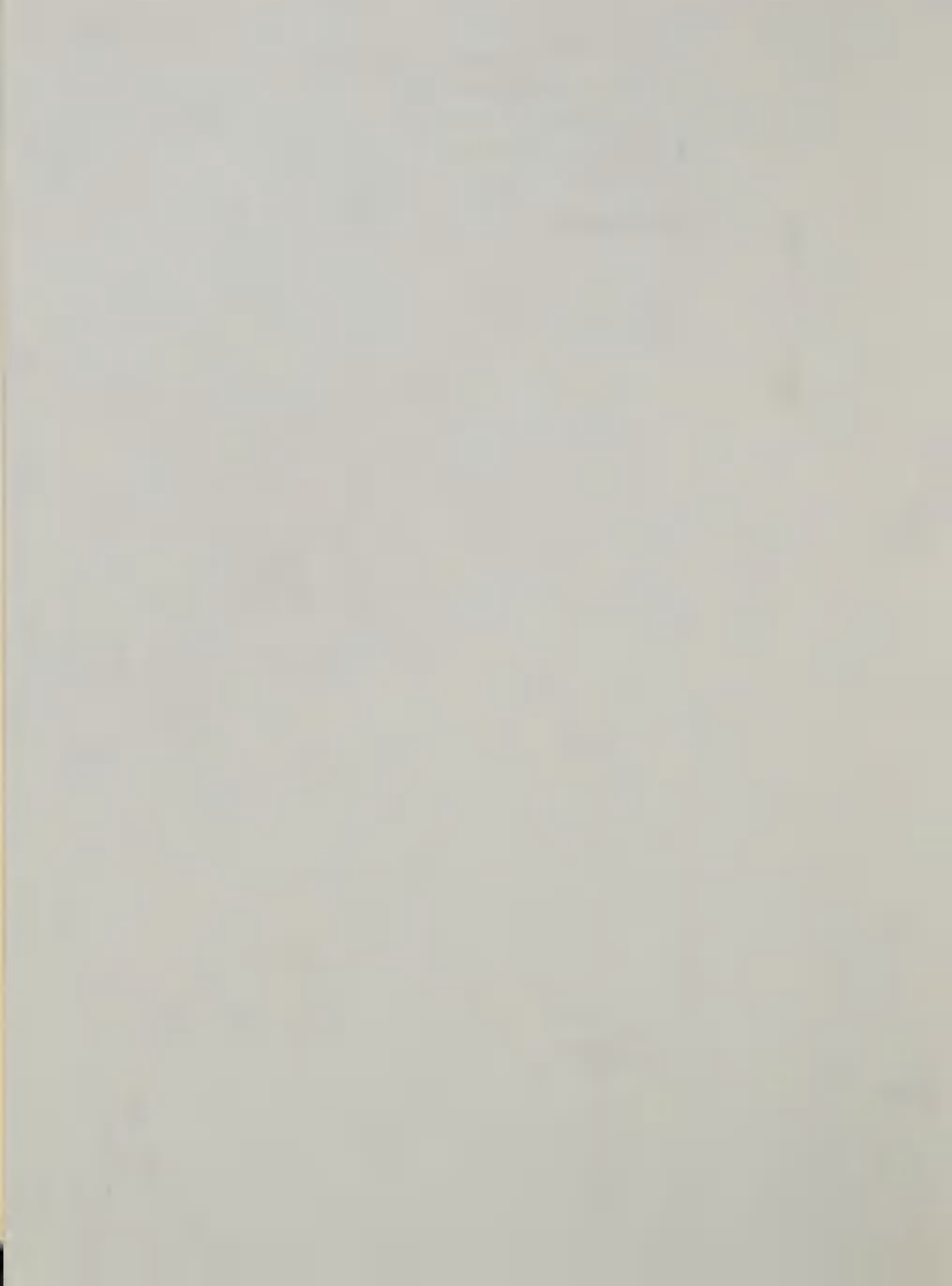
$$RI = \bar{n} \text{ segment 1} \times \bar{n} \text{ segment 2} \times \bar{n} \text{ segment 3} \times \bar{n} \text{ segment 4}$$

Jack Barry

APPENDIX F

GENERAL SITE MAP







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